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SEA OF CORTEZ EXPEDITION
OF THE
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June 20 - July 4, 1964

By

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The peninsula of Baja California and the Gulf of California are of particular biological interest and have had the attention of scientists of the California Academy of Sciences since long before the start of this century. In 1888 Walter E. Bryant made a trans-peninsular collecting trip from Isla Magdalena and San Jorge to Loreto. This initiated a series of expeditions which accomplished the basic biological exploration of the southern half of the peninsula and the outlying islands. Large and significant collections of the animals and plants were made by Bryant, Charles D. Hains, Gustav Eisen, Frank H. Vassil, T. S. Brandegee (who was independently associated with the Academy expeditions), and several others. Unfortunately those collections were destroyed by the fire which accompanied the San Francisco earthquake on April 18, 1906.

In 1921 the Academy conducted a very productive expedition to the islands of the Gulf of California. Using a sixty-five foot gasoline schooner, the *Silver Gate*, a scientific complement of eight, under the leadership of Joseph

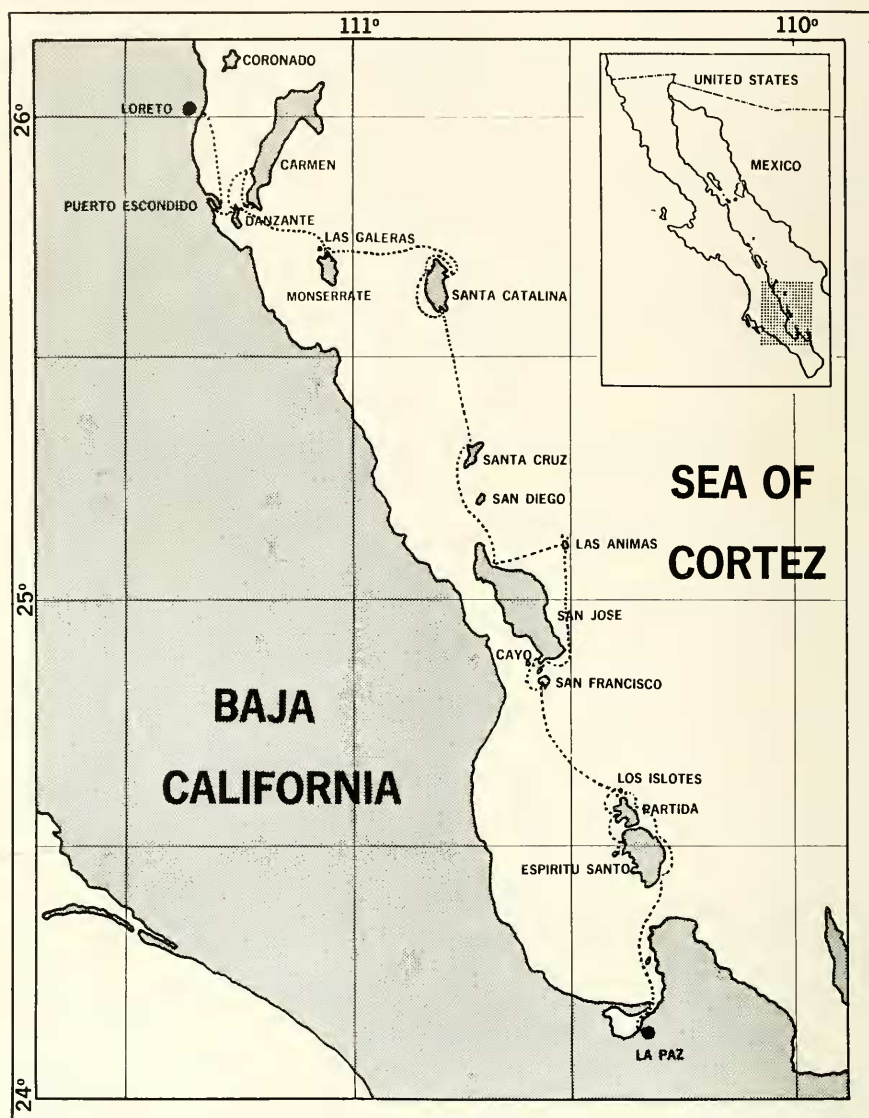


Figure 1. Route of the Sea of Cortez Expedition.

MAP BY BOB OLSON.

R. Slevin, spent 87 days in intensive field investigation. The resulting collections are an important part of the Baja California and Gulf of California material preserved at the Academy. This has been augmented by frequent but smaller collecting trips, many of the most recent of which were sponsored by the Belvedere Scientific Fund. Since 1914 more than 3,500 pages of the Acad-



Members of the expedition, left to right: Muñoz, Jr., Markham, Chivers, Herald, Tsegeletos, Adcock, Powell, Banks, Parrish, Wiggins, Villalobos F., Orr, Parker, Sloan, Bandar, Fuller.



The *Marisla* at Las Animas.

emy's *Proceedings* have been devoted to scientific accounts and reports of the biota of Baja California and islands of the west coast of Mexico.

Field work in the Gulf of California continues to be productive. The area is large and the islands are many. Modern diving techniques and equipment make possible the exploration of the fascinating submarine environment which earlier could only be inadequately sampled with dredges and other inefficient devices.

On December 16, 1963, Richard M. Adcock of the La Paz Skin Diving Service invited the Academy to use his new diving vessel, the *Marisla*, for two weeks of biological investigations in the southern part of the Gulf of California. The invitation was accepted and an area of unusual interest, the chain of islands between Loreto and La Paz, was chosen for the operation. Because of other activities by Academy personnel and Adcock's charter commitments, the period of June 20 to July 1 was selected for the trip.

It was early decided to place some emphasis on marine work, both because of the unique diving facilities offered by Adcock and because the Academy needed to augment its collection of marine invertebrates. Also, this served as an exploratory trip for possible sources of living fishes for the Steinhart Aquarium. But general collections of terrestrial organisms were made on most of the islands which were visited.

The scientific party included:

George E. Lindsay, Director, California Academy of Sciences, in charge.
Ira L. Wiggins, Scientific Director, Belvedere Scientific Fund, botanist.
Alejandro Villalobos F., Instituto de Biología, Mexico, invertebrate zoologist.

Robert T. Orr, California Academy of Sciences, mammalogist and ornithologist.

Earl S. Herald, California Academy of Sciences, ichthyologist.

David C. Powell, California Academy of Sciences, aquatic biologist.

Dustin Chivers, California Academy of Sciences, invertebrate zoologist.

Raymond Bandar, California Academy of Sciences, assistant to Dr. Orr.

Allan J. Sloan, San Diego Natural History Museum, herpetologist.

Richard C. Banks, San Diego Natural History Museum, ornithologist and mammalogist.

Chris Parrish, San Diego Natural History Museum, arachnologist.

Bruce E. Marquardt, student collector, particularly of marine organisms.

Francisco Muñoz, Jr., student collector.

A documentary film of the trip was made by the Television Department of the Academy. David Parker, director of the television series "Science-in-Action," and Dana Fuller, cinematographer, were members of the expedition. George Tsegeletos, an experienced diving instructor and underwater camera-

man from San Rafael, California, volunteered his services and was a very valuable member of the party, both as cameraman and collector.

Richard Adcock had three guests, Bruce Markham of Pocatello, Idaho, and Dr. and Mrs. Wright Cortner of Tucson, Arizona, all of whom participated in the expedition activities and made valuable collections for the biologists.

It was first planned to be aboard the *Marisla* for two weeks, but the schedules of some of the biologists and Adcock's commitments for his vessel reduced this to 11 days. In order to take full advantage of the time, Adcock suggested that he meet our party in Loreto and that the trip end in La Paz. Arrangements were made with Captain Francisco Muñoz, of the Servicio Aereo Baja, to fly the Academy party from Tijuana to Loreto on June 20 and from La Paz to Tijuana on July 4.

We met at the Tijuana International Airport at 0900 June 20. Villalobos had flown from Mexico City the previous day. Personnel from San Francisco drove or flew to San Diego. Members of the staff of the San Diego Natural History Museum had assembled supplies and equipment and transported it to Tijuana. They also drove our party from the San Diego airport to the Tijuana airport. The same help was provided on the return trip, for which I express appreciation.

LOG OF THE TRIP

June 20, 1964. Tijuana to Puerto Escondido.

We departed from the Tijuana International Airport in a Lockheed Lodestar at 1034. Captain Francisco Muñoz was the owner and pilot, and Victor Manuel Corral his co-pilot. Our 15 passengers and their bulky collecting gear made a near-capacity load.

The direct course to Loreto is 575 miles. As we flew southeast down the peninsula the San Diego Museum people, who are very familiar with this area, pointed out landmarks and interesting features to those who had not flown there before. At first we were over chaparral-covered hills, and could see the rugged crest of the Sierra de Juárez on our left and the seaport of Ensenada on our right. The country became more arid as we passed over the old mining town of El Alamo and Valle de la Trinidad, and we could see the north end of the Gulf of California (Sea of Cortez) to the east. Our route took us over the great range of the Sierra San Pedro Martir, which is an undulating forested plateau with an average elevation of more than 7,000 feet and one peak, La Encantada or Picacho del Diablo, which reaches 10,000 feet. Flying on, our course took us down the "backbone" of the peninsula. The mountains beneath us were arid but arroyo bottoms were sometimes lined with palm trees. The narrowness of the peninsula was apparent, with the islands of the Sea of Cortez visible on one side of the aircraft and the top of Isla Cedros rising above the Pacific fog on the other. We saw Bahía San Luis Gonzaga with its assort-



Figure 2. A chartered Lockheed Lodestar aircraft transported expedition personell from Tijuana to Loreto, and La Paz to Tijuana.

ment of brown islands, Bahía de los Angeles with Ballenas Strait and Isla Angel de la Guarda in the background, the volcanic Tres Vírgenes peak near Santa Rosalía, the great expanse of Bahía Concepción, and then the village of Loreto. We were happy to see the *Marisla* waiting as we “buzzed” the town to alert all four of its taxis to our need for their services at the airport. We landed at 1324.

The airplane was unloaded and taxis transported people and equipment to the dock, where Richard Adcock gave each of us a warm welcome and a cold bottle of beer, and introduced us to his vessel.

The *Marisla* is a houseboat built on a LCM hull. It is 60 feet long and has a 20-foot beam, and draws only three feet. Twin 671 GMC diesel engines provide a normal cruising speed of 10 knots. There are six double staterooms for guests, a galley, and owners’ and crews’ quarters in the cabin area. The pilot house, a large sundeck, and an open dining area are above. The *Marisla*



Figure 3. Baggage and equipment were unloaded in the landing strip at Loreto.

proved to be comfortable and admirably suited to our island work. Its shallow draft, great maneuverability, and sturdy steel hull made it possible to use the craft inshore and next to rocks where conventional vessels could not have ventured. Adcock had a crew of six; three men to operate the boats and equipment and three girls for the galley and housekeeping chores.

A 36-foot LCPR, equipped with a compressor for charging airtanks, and with other diving equipment, was used as a general utility boat. Its bow ramp facilitated landings, and when lowered into the water the ramp served as a diving stage. This boat was used constantly to transport personnel, service divers, make plankton hauls, and for other purposes.

Loreto is a picturesque and historic spot, the place where Jesuit Juan María Salvatierra established the first permanent California mission in 1697. The massive stone mother mission with its recently reconstructed tower dominates the village of modest houses, most of which are concealed in groves of date palms. We visited the mission and did final shopping while waiting for the Captain of the Port to complete our authorization to sail.

Departing from Loreto at 1750, we cruised south about 13 miles to the

little land-locked harbor of Puerto Escondido, where we arrived at dusk. The inner harbor is about a mile long and a quarter of a mile wide. Its narrow entrance is only 75 feet wide, with a depth of nine feet at high tide, and the advantage of the *Marisla's* shallow draft was demonstrated when Adcock cruised through without slowing, a thrilling experience.

Collecting started immediately, the same day most of us had left San Francisco. Sloan, Parrish, and Bandar were ashore with a light, looking for snakes and scorpions--and followed by cameraman Fuller and director Parker. From the boat we heard shouts ashore, and occasionally the brilliant light of Fuller's daylight floods indicated the chase was being filmed. Two Baja California rattlesnakes; *Crotalus enyo enyo*, and seven scorpions, *Hadrurus hirsutus*, and *Vejovis spinigerus*, were taken and their capture photographed. At the same time the launch took the divers to a rocky point off the outer harbor for night diving with lights. Many marine creatures, vertebrates and invertebrates, come out only in the dark. For example, *Dolabella californica*, a large opisthobranch mollusk, was common but was usually seen only at night.



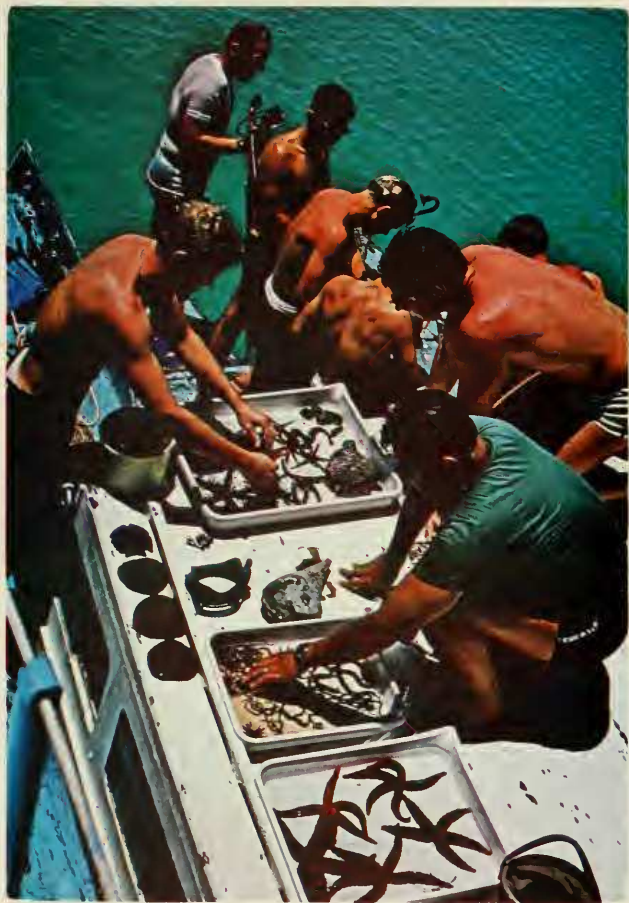
Figure 4. Skipper Richard Adcock and the young ladies in charge of the galley watching Dick Banks prepare a study skin.



Figure 5. An aerial view of Puerto Escondido, which was our anchorage the first night.

June 21. Puerto Escondido to Isla Danzante.

Dawn revealed the beauty of our little "hidden harbor," backed as it was by the towering red cliffs and crags of the rugged Sierra Giganta. The east side of the bay was lined with mangroves and the west side with mud flats, then with a green line of *Allenrolfea occidentalis*, *Salicornia pacifica*, and *Laguncularia racemosa*, which gave way to the spiny trees and cacti typical of the Sonora Desert flora. Sloan, Banks, and Bandar were ashore at daylight. The divers were soon in, collecting and filming. Giant hatchet clams, or pinnas, *Pinna rugosa*, were collected for specimens and food. Some of these were fourteen inches long and were difficult to remove from the sand in which they were embedded. The mouth of the bay through which the tide raced was particularly rich in sea stars and other life, specimens of which were taken.



More than twenty-five species of starfish, sea urchins, and brittle stars were taken at Isla Danzante.

It was apparent that our Mexican colleague, Dr. Villalobos, had broad interests as he divided his time between marine and land collecting. At Puerto Escondido he first dove, then was ashore with an insect net, and next was collecting swimming crabs from the sand beach and moments later other crabs from the mangroves. Dr. Villalobos was a most enthusiastic and learned biologist and a fine companion.

For several of our people this was the first visit to southern Baja California, and they prowled through the thickets of desert plants noting the birds and other inhabitants of an interesting area.

At 1000 we had a short discussion of our general plans for the operations of the following ten days. then departed from Puerto Escondido and made the three-mile run to the northwest side of Isla Danzante. We anchored in a beautiful little cove with our bow secured to shore and a stern anchor which snubbed the vessel just short of touching. Water was so clear that when the launch drifted in at our side it appeared to be suspended in the air.

Divers were in the water immediately, and found this a most productive station for echinoderms. More than 25 species of starfish, sea urchins, and brittle stars were taken. Sorting trays filled with specimens covered more and more of the deck space of the *Marisla*.

Isla Danzante is a rough little island, only three and a half miles long and less than 500 feet high, and from the air it looks like a giant lizard. It was dry and land collecting was poor. Orr, Banks, and Bandar trapped but caught only six spiny pocket mice, *Perognathus spinatus seorsus*. Parrish, Muñoz, Marquardt, Sloan, and Lindsay collected after dark, finding only two scorpions, *Centruroides exilicauda*, some grasshoppers, camel crickets, and tubercular geckos. While waiting to be picked up on the beach we found isopods abundant and easy to capture, and bottled a large series of *Ligyda occidentalis*. No snakes have been reported from Isla Danzante, but Bandar found a fragment of a shed skin of a large snake while setting his traps. It was not collected at the time and he was unable to locate it the next day.

A thirty-gallon aquarium was set up on the large table which served as an all-purpose laboratory. Fishes were captured and held for observation and eventual shipment to San Francisco. The fish were taken with small hand nets, with "slurp guns" which sucked them into a chamber, with dip nets around a light at night, and with the chemical, quinaldine, which anesthetized them when introduced into the water. At Danzante four curious gulf jawfish, *Opisthognathus punctatus*, blennies which live in holes in the mud bottom with only their massive heads exposed, were taken, as were many other very colorful and interesting species. The capture of the expedition's only pipefish, *Doryrhamphus melonopleura*, which proved to be a record for this area, pleased Herald.

June 22. Isla Danzante to Isla Carmen.

The launch was sent to Loreto for ice and instructed to meet us at Bahía Marquer on the southwest side of Isla Carmen. Mammals and birds were skinned and prepared, other specimens were sorted and preserved, and our laboratory table had full use as we cruised to Carmen. We arrived at Bahía Marquer at 1000, just as the launch pulled in from Loreto.

Ashore there were tremendous deposits of fossils. While the marine biologists were diving, the land party worked up a steep-sided canyon which cut through the fossil-bearing strata. An endemic barrel cactus, *Ferocactus diguetii carmenensis*, bore red flowers, and there were many little *Wilcoxia striata* plants, rare little cacti which had pencil-thin stems and dahlia-like tubers. A native cotton, *Gossypium armourianum*, with its striking sulphur colored flowers, each petal of which bore a spot of red at its base, was one of the few plants in blossom. Another was *Pedilanthus macrocarpus*, a milky-juiced

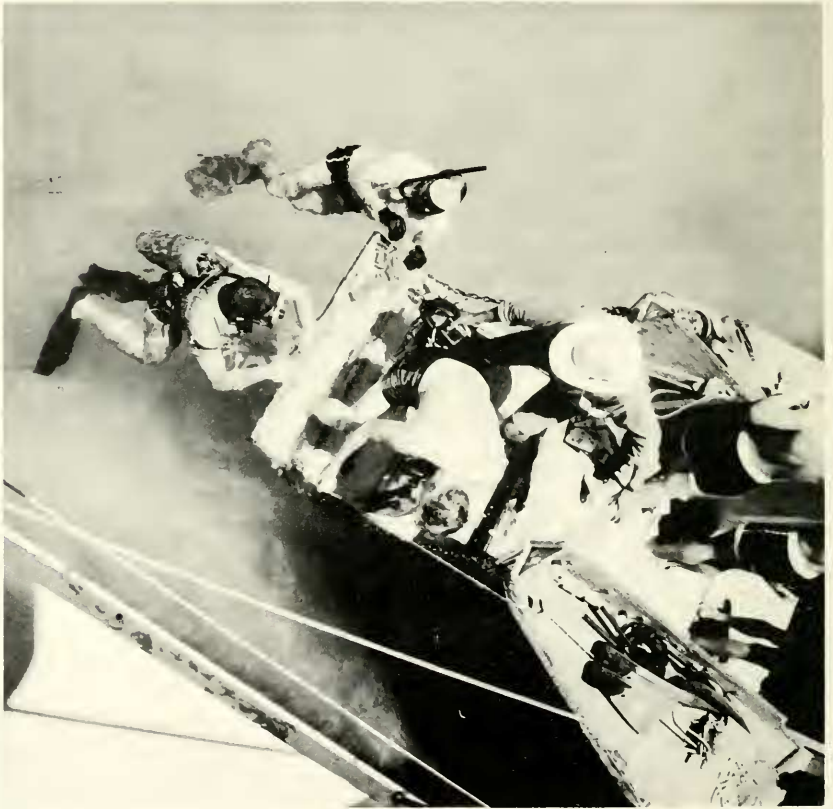


Figure 6. The lowered lowramp of the launch made an excellent diving platform.



Figure 7. Expedition members Sloan, Bandar, Parrish, Villalobos F., and Orr return from an island.

succulent spurge with slipper-shaped red flowers. Fossils, a few plants, and some birds were collected ashore, and were prepared during the short run to the southern low-lying end of the island, where anchorage was made for the night.

The launch took the divers to a deep area off the north end of Isla Danzante, while the shore party worked the fossiliferous limestone flats of Isla Carmen. Pectens, rock oysters, and many types of gastropods were the most common fossils. Parrish collected nine specimens of four kinds of scorpions in decaying giant cactus; *Hadrurus hirsutus*, *Broteas alleni*, *Vejovis spinigerus*, and *Centruroides exilicauda*. Orr observed or collected ash-throated flycatchers, black-throated sparrows, ladder-backed woodpeckers, verdins, blue-gray gnatcatchers, white-winged doves, cardinals, oyster catchers, and Wilson's plovers. A large school of dolphins, *Lagenorhynchus* sp., passed during the afternoon.

The island was very warm and all hands took to the water as soon as they got back to the beach. The divers returned from Danzante with a big cabrillo which Adcock had speared at a depth of 125 feet, and which was cooked for supper. After dark, Sloan captured a spotted night snake of the genus *Hypsiglena*.

June 23. *Isla Carmen to Las Galeras and Isla Monserrate.*

Trapping was poor and only one white-footed mouse, *Peromyscus eremicus carmeni*, and two spiny pocket mice, *Perognathus spinatus occultus*, were caught--but one of Bandar's mousetraps held a large scorpion, *Hadrurus hirsutus*! About 0900 the *Marisla* was moved back to the northeast end of Isla Danzante, which the divers had found profitable the previous evening. The island ended abruptly in huge undersea cliffs. Tsegeletos filmed the colorful fishes and a large green moray eel, while Fuller recorded "Sally Lightfoot" and other crabs.

The great variety and beauty of the fishes and other marine animals, and of the marinescapes themselves, were in remarkable contrast to the sterile and forbidding cliffs above. Some of the divers worked the depths as two-man teams while others explored the fissures in the barely submerged rocks with only snorkel equipment. It was a fantastic place. Among the common starfish were *Acanthaster ellissi*, *Mithrodia bradleyi*, *Othilia tenuispina*, and *Oreaster occidentalis*. *Ophiocoma aethiops* and *Ophiocoma occidentalis* were abundant serpent stars. But two brilliant purple starfish were the rare *Leiaster teres*, which in 1941 was known from only three specimens. The genus has only six species, and *L. teres* is the only one from the eastern Pacific. Colorful bumpheads and parrot fish, and snake eels which looked like kingsnakes,



PHOTO BY BRUCE MARKHAM

Figure 8. A bottle-nosed dolphin jumping clear of the water near Las Galeras.

and little fish which looked like jewels against the brown algae and sargasso weed, held the attention of photographers and divers until we reluctantly departed toward Isla Monserrate at 1300, lunching enroute. We stopped at two rocks, Las Galeras, anchoring the *Marisla* in the shallow channel between. Frigate birds were soaring overhead as Wiggins, Sloan, Bandar, and Lindsay explored the eastern rock, which is seventy feet high, and Orr, Banks, and Parrish, accompanied by Parker and Fuller for film coverage, went to the lower western one. These were barren and desolate islets which in season are active bird rookeries. The divers found the area of little interest, but did capture a rare slipper lobster, *Evibacus princeps*, of the family Scyllaridae, as well as spiny lobsters, *Panulirus inflatus*.

As the launch picked up the shore party from West Galeras, a large school of jumping, bottle-nosed dolphins, *Tursiops*, passed--and the chase was on! The beautiful animals were in a particularly playful mood and jumped high out of the water, landing with great splashes on either side of the launch. It was a wonderful display of animal vigor.

We anchored off sand dunes at the north end of Isla Monserrate. The film crew again photographed Sloan and Parrish collecting rattlesnakes at night. Bandar bagged five specimens of *Crotalus ruber*. Ghost crabs, *Ocypode* sp., and land hermit crabs, *Coenobita* sp., wandered about springing mousetraps and startling biologists. Banks caught a pocket mouse by hand.

June 24. Isla Monserrate to Isla Santa Catalina.

A very brisk wind rose during the night and some equipment was lost overboard. The anchors were readjusted, and by morning the wind had abated and the sea was again calm. The terrestrial collectors were ashore early. Five traps held hermit crabs, but four specimens of *Perognathus* and one of *Peromyscus* were caught. Banks took the first speckled rattlesnake, *Crotalus mitchelli*, to be recorded from Monserrate, and the second king snake, the first having been collected by Curtis Croulet and Sloan in April, 1964. Banks and Wiggins each picked up a racer, *Masticophis flagellum*. The divers did general collecting until everybody was aboard and we departed on the 15-mile run to Isla Santa Catalina at 1030. Finback whales were observed in the distance. During the crossing Dick Adcock and Dr. Cortner lectured on the use of SCUBA equipment and the physiology of diving.

Isla Santa Catalina is about seven and one-half miles long, two miles wide, and is 1543 feet high. Its orientation is north and south. It is precipitous but good anchorages are to be found in coves. We went to the north end of the island, cruising close to the rocks to observe California sealions which were sunning themselves. Villalobos, Wiggins, Sloan, Parrish, Fuller, Parker, and Lindsay were put ashore at a cobble spit on the northeast side of the island at 1230. Parrish found scorpion collecting excellent, getting nine speci-

mens of three genera, *Broteas*, *Vejovis*, and *Centruroides*, from one decaying cardon. Spectacular giant barrel cacti, *Ferocactus diguetii diguetii*, some of which were more than ten feet tall, were photographed. Isla Catalina is the type locality of this largest of barrel cacti, which is endemic to a few Gulf islands. The clean and chic cardons, *Pachycereus pringlei*, were nearly spineless and carried quantities of large, bristly golden-colored fruit which looked like chestnut burrs. Some of these were split open, the rind curling back to reveal bright red flesh and glistening black seeds which were esteemed by white-winged doves and Gila woodpeckers.



Figure 9. Expedition members Wiggins, Villalobos F., Parrish, Sloan, Parker, Lindsay, and Fuller on Isla Santa Catalina.

By this time the divers were eagerly wading into the problems of fish identification. Although Herald had worked at many places in the Indo-Pacific, and Powell had worked in the upper Gulf, neither was familiar with the fauna of the entire Gulf, and its numerous endemic species. Tentative identifications were made of all fishes as they were brought aboard and tested for "aquarium toughness" in the shipboard tank.

While our land party was ashore, the *Marisla* returned the divers to the north end of the island to explore among the large rocks. Pelicans and brown boobies were abundant. The *Marisla* stayed in a cove on the northwest corner of the island until the shore party was picked up at 1430, then moved south a short distance to an anchorage where an arroyo gave access to the interior. A pod of perhaps fifty bottle-nosed dolphins escorted us on the way.



Cardon cacti in an arroyo on west side of Isla Santa Catalina.



Fruit of the cardon cactus, *Pachycereus pringlei*.



Figure 10. Chris Parrish found nine scorpions of three genera, *Broteus*, *Vejovis*, and *Centruroides*, in one decayed cardon cactus.

Sloan was particularly interested in collecting *Crotalus catalinensis*, the "rattleless rattlesnake," which is endemic to this island. Only four specimens were known, the holotype taken by Frank Cliff on the *Orca* cruise in 1953, two specimens taken on the Belvedere Expedition of the San Diego Natural History Museum in 1962, and one living specimen which Sloan collected while cruising with the *Gringa* in April, 1964. Bandar, Sloan, and Banks collected three more during the evening, as well as one specimen of *Hypsiglena torquata*, a spotted night snake taken on Isla Santa Catalina only once before. Banks shot a big-eared bat, *Plecotus townsendii*, for the first record from a Gulf island. Parrish found scorpion collecting good at the junction of the arroyo with the rocky hillside encountering those of *Broteas* under rocks and representatives of *Centruroides exilicauda* our running around.

June 25. Isla Santa Catalina.

Sloan collected five additional "rattleless rattlesnakes"! The first was found by Banks, coiled next to one of his mousetraps, where it was photographed by Wiggins. Sloan saw the second one under a *Pithecellobium* bush, and he then collected three more in a pile of brush under a large *Bursera* tree.



Figure 11. Lunchtime for the shore party on Isla Santa Catalina.

Sloan used a hand cultivator for searching through brush piles. It is an excellent tool. Lindsay picked up a second specimen of *Hypsiglena*. Three shed skins of *Crotalus catalinensis* were found under one bush. Sloan and Wiggins collected a long series of a live, endemic land snail, *Bulimulus johnstonii*, which was abundant under loose rocks and on the underside of logs.

Isla Santa Catalina has a fairly heavy vegetation cover. The cardon cactus, *Pachycereus pringlei*, barrel cactus, *Ferocactus diguetii*, sweet pitahaya, *Lemaireocereus thurberi*, senita, *Lophocereus schottii*, and sour pitahaya, *Machaerocereus gummosus*, form natural cactus gardens. Other typical plants are ironwood, *Olneya tesota*, palo verdes, *Cercidium microphyllum* and *Cercidium* sp., copals, *Bursera microphilla* and *B. rhoifolia*, jojoba, *Simmondsia chinensis*, and *Beleperone californica*. Near the beach the succulent *Abronia maritima* bore deep crimson flowers, and in the lower arroyos the desert poppy,



ZOOLOGICAL SOCIETY OF SAN DIEGO - R. VAN NOSTRAND.

Figure 12. A "rattleless rattlesnake," *Crotalus catalinensis*, which John Sloan collected on Isla Santa Catalina.



ZOOLOGICAL SOCIETY OF SAN DIEGO - R. VAN NOSTRAND.

Figure 13. The vestigial rattle of the "rattleless rattlesnake."

Argemone sp., was also in blossom.

Diving was excellent. A school of bottle-nose dolphins came into our cove. Two divers with cameras swam to join them, but the dolphins withdrew.



Figure 14. Dr. Alejandro Villalobos F. examining a giant barrel cactus, *Ferocactus diguetii diguetii*, at its type locality, Isla Santa Catalina. Cardons, *Pachycereus pringlei*, in the background.

The divers speared a large garropa and the sequence was filmed, then the fish was broiled over charcoal for lunch. This was a prolific spot for large fishes - amber jack, yellow tail, groupers to 300 pounds, golden cabrillo, and many others. Near the rocks there were many species of reef fish, parrot fish, wrasses, and others. In the bottom at intermediate depths were "forests" of burrowing eels which live in holes in the sand with only their heads and a few inches of their bodies exposed - all looking in the same direction. As a diver approached they sank out of sight, to reappear as soon as he passed. All attempts to anesthetize or dig out specimens were unsuccessful. The same experience was encountered later at Cabo San Lucas, and the reason is that this

eel, whose exact identity is unknown at the moment, undoubtedly belongs to the pointed-tail ophichthid family, most of whose members can swim faster backwards in the sand than we less well endowed human beings can swim forwards. Dr. William Beebe, one of the first divers in the gulf area, described these phalanxes as "gardens of eels" in his volume on the *Zaca Venture* (1938). The Aquarium staff is currently working on an eel-dredge that will sneak up on these wary beasts faster than any skindiver; so if all goes well, Steinhart will eventually have this elusive eel on display for the first time. Night collecting was most interesting at Isla Santa Catalina. Many invertebrates, as well as such fish as squirrel fish, were noted at night only. One of the spectacular nocturnal invertebrates was the giant worm-like sea cucumber, *Euapta godeffroyi*, which was common and sometimes more than five feet long and three to four inches in diameter! A large nocturnal opisthobranch, *Dolabella californica*, was also collected.

We cruised down the west side of the island in the afternoon, anchoring for the night in a beautiful cove near the southern end. A metal meteorological tower seemed incongruous in that deserted region. There was also an abandoned shark fisherman's camp, with primitive shelters, turtle carapaces filled with salt, dried shark skins, and many carcasses of hammerhead and bonito sharks. Bandar caught another specimen of *Crotalus catalinensis*, making a total of nine of a rare reptile of which only four had previously been known. Parrish caught 30 scorpions in two hours, 16 of which were taken from one decaying cardon. Four western pipistrel bats, *Pipistrellus hesperus*, were shot at dusk. During the night the marine biologists collected in the littoral zone at low tide.

June 26. Isla Santa Catalina to Isla Santa Cruz and Isla San José.

The land party was ashore at 0600 and found only empty traps. Fuller and Parker filmed Sloan capturing a rattlesnake, and with Herald recorded the deserted shark camp. We were underway on the 20 mile run to Isla Santa Cruz at 0745. After breakfast the biologists prepared specimens and wrote up field notes. We arrived at Isla Santa Cruz at 1130, and anchored for an hour at the northwest end. Wiggins and Lindsay worked on shore while the others dove or swam. There were many fish and several interesting nudibranchs, two of which are apparently undescribed.

We passed Isla San Diego without stopping. Tsegeletos' new Bolex camera froze, and since it was our only underwater camera capable of fulfilling our requirements, we had decided to accelerate our schedule and try to have one flown from La Paz to Isla San José. Adcock contacted a yacht at La Paz by radio and attempted to make the arrangements. We arrived at Arroyo Aguada, on the northeast side of Isla San José, at 1645.

Parrish and Sloan captured two specimens of *Crotalus ruber* at the edge of a broad sandy arroyo which ran inland from the beach. Bandar captured one of *Crotalus mitchelli*, and Lindsay took a leafnose snake, *Phyllorhynchus decurtatus*, for an island record. Wiggins followed a fresh snake track to find a freshly dead example of the endemic brushrabbit, *Sylvilagus mansuetus*, which the reptile had apparently killed and was unable to swallow. The rabbit's skull was preserved, and additional specimens were taken. At dusk two bats, *Pipistrellus hesperus*, were shot by Orr and Parrish. Bandar spent the night on shore.

The divers found a good place to collect lobsters and got 16, most of which were broiled for dinner. Lobster shells thrown into the water attracted many four-to six-foot-long sharks, some of which were hooked but not landed. Villalobos headed a group which collected with dip nets around the night light and many small crustaceans were preserved.



Figure 15. Fuller photographing squids, *Sthenoteuthis bartramii*, which Chivers and Powell had just netted near Las Animas. Bandar looks on.



Figure 16. A young brown pelican, *Pelecanus occidentalis*, on Las Animas.

June 27. Isla San José to Las Animas and Isla San José.

At daybreak a school of active pilot whales passed just off the bow and were silhouetted against the red sky of pre-sunrise as they rose high out of the water. Pelicans dove repeatedly. Wiggins and Muñoz were ashore early collecting fossils from the cliffs and bluffs north of the landing beach. Some of the fossil strata were 20 feet thick and contained pectens, rock oysters, some sand dollars, and sea biscuits. Orr, Banks, Bandar, and Sloan took care of their traps and hunted for two and one-half hours before breakfast.

We departed for Las Animas at 0900 and the 11-mile run did not give sufficient time for most of the biologists to prepare their specimens. Nearing

Las Animas we saw a red swirl of disturbed water which contained a mass of squid, several of which were netted. The cephalopods appeared to be breeding and were being fed upon by fish. Their remarkable color changes from red to mottled to white and back again were photographed, and the animals were later identified as *Sthenoteuthis bartramii*. Although it has been taken from the mid-Pacific and has a wide distribution, it has apparently never been reported from the Gulf of California.

Las Animas is a group of whitewashed rocks, the largest of which is a few hundred yards long and ninety feet high. It is a rookery for pelicans and brown boobies, and abandoned nests and ambulatory checks indicated heavy use by the birds. We anchored in a beautiful cove after circling the rocks to observe California sea lions, but only eight animals were seen, five of which were adult males and three were subadult or females. Parrish and Wiggins found *Vejovis* and *Centruroides* scorpions and two lizards, *Phyllodactylus xanti* and *Urosaurus microscutatus*. A large finback whale surfaced near the islet and a marlin was observed jumping time after time. A huge school of "pargo lisa" or red snapper worked by the rocks, turning the water red. An adult bull sea lion swam by a school of several kinds of fishes with complete indifference, and in turn was ignored by the fish.



Figure 17. Bruce Marquardt and Francisco "Kiko" Muñoz watching Bob Orr pinning down mammal specimens.

The divers reported the area was extremely rich in fishes and invertebrates and the water was crystal clear. George Tsegeletos regretted that his camera was inoperable. A short-spined but very toxic urchin, *Toxopneustes roseus*, "bit" Dr. Villalobos in the palm of his hand, apparently with a single pedicellaria but it caused him considerable pain and his hand became discolored.

We took two turns around Las Animas for a final look at the sea lions and departed for the southwest side of Isla San Jose, where we anchored a short distance south of the mouth of the lagoon at Bahia Amortajada. Orr, Wiggins, Sloan, Banks, Bandar, Parrish, and Lindsay went ashore about one-half mile north of the lagoon at 1800 to set traps and collect. Parrish caught a huge scorpion, *Hadrurus hirsutus*, 6-5/8 inches long. This was a new record for the island and also presented Parrish with problems in its capture, because its tail was longer than his forceps and the animal was larger than his vials. Jets of venom were ejected as it stabbed at the stick with which he held the animal down. Finally it was backed into a vial and secured. This specimen was nearly as large as those of *Pandinus imperator* of Africa, the largest scorpion, which reaches 7-1/4 inches.

Reptile collecting was good. Red rattlesnakes, *Crotalus ruber*, and several racers, *Masticophis flagellum*, were taken, as were geckos. Bandar also collected two beach skulls of false killer whales, *Pseudorca crassidens*, the seventh and eighth records from the eastern Pacific Ocean.

As usual, bats appeared and were hunted just at dusk. They are difficult targets for 22-caliber shot pistols. A fusilade of pistol shots, punctuated by an occasional blast of a shotgun, netted a big brown bat, *Eptesicus fuscus*, and two representatives of *Pipistrellus hesperus*, new records for the island.

Biting gnats, "no-see-ums" or "jejenes," were bad before the shore party was picked up at 2030, and were worse on the boat. Everybody had a miserable night and Tsegeletos and Parrish were ill as a result of the bites the next day. Reaction time varied with the individuals. Francisco Muñoz became covered with lumps five days later.

June 28, Isla San José to Isla Cayo, Isla San Francisco, Isla Partida, and La Paz.

We were up with the "jejenes" early. Orr, Banks and Bandar made a hurried trip ashore to pick up their traps, which contained a fair catch. We moved out to Isla Cayo, a rocky ridge about one-quarter mile long and 40 feet high, where the capture of fish-eating bats, *Pisonyx livesi*, was filmed. The bats were found in crevices in cliffs over the water. A great number of purple martins, *Progne subis*, swooped about the cliffs and some were collected by Sloan for Banks, who found that the behavior of the birds and the gonadal condition of the males suggested that they were nesting, but this was not con-



Figure 18. Wright Cortner, Bruce Markham, and George Tsegeletos repairing their diving suits.

firmed. Martins are birds of montane forests or palm oases in Baja California and nest in holes in trees. Thus their presence on this tiny, treeless, guano-covered rock was surprising.

We moved south past Isla Coyote and its picturesque cluster of houses belonging to a large family of fishermen, then anchored for two hours in a beautiful cove at the southwest corner of Isla San Francisco. The usual collecting was carried on, then we cruised to and circled Los Islotes for Orr to reconnoiter the sea-lion herd he was to study later, and left Bandar and the launch in a cove on Isla Partida. Our efforts to arrange for the air delivery of a camera having failed, we proceeded to La Paz, arriving at 2100.

George Tsegeletos and Lindsay contacted Mr. William Curry who very generously loaned us his Bolex camera which fitted Tsegeletos' underwater camera box. The *Marisla* was watered and ice and coke were brought aboard. The biologists visited the town.

June 29. La Paz to Isla Partida.

We departed La Paz at 0200. The wind was up and the seas were rough, so we cruised up the sheltered east side of Isla Espíritu Santo and Isla Partida, to round the north end and anchor at 0615. Bandar came aboard with six mice, *Perognathus* and *Peromyscus*, three of which he caught in a single trap beside his sleeping bag. Orr was taken to Los Islotes, three rocky islets about one-half mile off the northern end of Isla Partida, to study the colony of sealions there. Wiggins, Banks, and Parrish climbed an arroyo on Isla Partida to a large dry lake which was bordered with cliffs and *Ficus palmeri*, *Forchammeria watsonii*, and *Lysiloma candida*. They shot a "black" jack rabbit, *Lepus insularis*, for which islas Partida and adjacent Espíritu Santo are famous among mammalogists. Most of the biologists did marine collecting or underwater photography.

In the afternoon we cruised south along Isla Partida, looking for an anchorage from which a shore party could have easy access to the interior of the island. We passed up several attractive coves for one reason or another, and finally stopped for the night in a picturesque little bight in Isla Espíritu Santo, which Adcock called Bahía Cañon. Actually, it was a little box canyon with black basalt cliffs capped with red rhyolite. There were many caves, some of which were explored by Wiggins, who found metates, bones of small mammals and fish, and other evidences of human occupation. There were bat droppings and an accumulation of butterfly and dragonfly wings among the stones on the floor, but no bats were observed. Wild figs, *Ficus palmeri*, and stunted cacti grew on the cliffs.

The water was not clear, which disappointed the divers, and the land collecting was poor. Banks used a predator call on shore, because Adcock had seen a ring-tailed cat, *Bassariscus astutus*, at the end of the cove - but the lure did not work.

June 30. Isla Espíritu Santo to Isla Partida, Los Islotes, and Espíritu Santo.

The launch took Orr and Fuller back to Los Islotes to study and film the sea lion colony, and carried divers to work the north end of Isla Partida. The *Marisla* stopped at Bahía Candelero. Dr. Villalobos wanted to find *Berthelinia chloris*, a small bivalved gastropod that is associated with the seaweeds of the genus *Caulerpa*, which had been collected at that spot before by Adcock. Two species of *Caulerpa*, *C. sertularioides* and *C. racemosa*, were found, but no representatives of *Berthelinia*. There is a walled well or spring of fairly fresh water at the mouth of an arroyo behind the beach. Sloan had noticed that a pool below the spring held fish in April, so he collected several for Herald. They were an eleotrid species, *Dormitator latifrons mexicanus*, which are known to frequent brackish water. Sloan and Wiggins used snares

to capture seven handsome turquoise-colored banded rock lizards, *Uta thalassina*. The walls of the canyon were of red rhyolite, and there were large cliff faces and caves, some shaded by wild fig trees. The lizards were quite tame, sitting on the vertical walls and watching us, or sometimes creeping or even darting away. Wiggins also collected a fine specimen of *Cnemidophorus maximus*.

The *Marisla* cruised to the north end of Isla Partida to meet the launch, which had picked up Orr and Fuller from Los Islotes. There Orr had noted fish-eating bats, purple martins, and made important observations of the large colony of California sea lions which inhabits the islet. At 1400 we started cruising down the east side of the island. At one point we stopped and George Tseg-eletos, Bruce Markham, Wright Cortner, and Richard Adcock made a deep dive to 190 or 200 feet, bringing up magnificent gorgonians, a basket star, and a



Figure 19. John Sloan holding a banded rock lizard, *Uta thalassina*, which he noosed at Bahia Candelero.